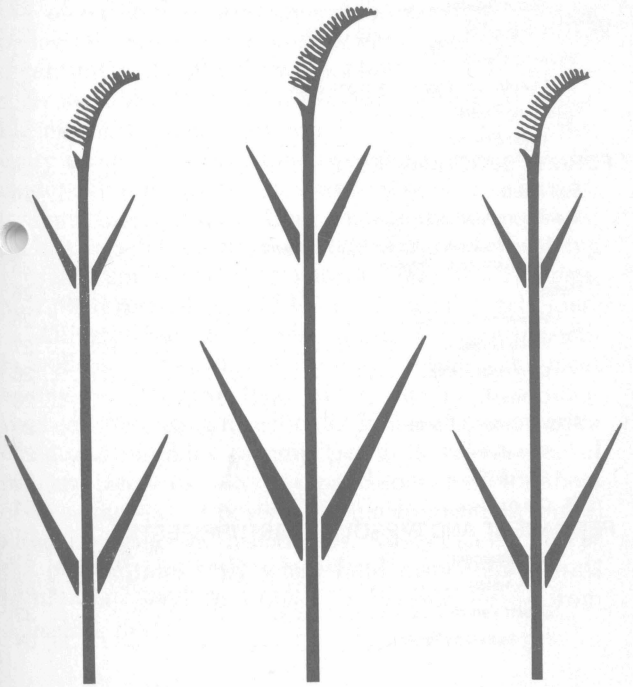
B-1401

,ing Insect and Mite Pests of Legumes, Grasses and Forage Crops in Texas



Texas Agricultural Extension Service
Daniel C. Pfannstiel, Director
The Texas A&M University System
College Station, Texas

CONTENTS

Managing Insect and Mite Pests of Legumes, Grasses and Forage Crops in Texas

Charles W. Neeb and John G. Thomas*

Suggestions in this publication are based on the results of an annual review of pest management research and concepts developed by a committee of state and federal research personnel and Extension specialists. Insect management practices are directed toward the most effective, safest and most profitable means of minimizing crop loss from insect pests.

In planning an insect pest management (IPM) program, the producer should consider the effective use of cultural control practices, naturally-existing biological control agents and accurate field scouting to determine action levels (when chemical control measures are warranted). IPM programs utilize all available means to keep pest numbers below levels that cause economic crop damage. Management tools include: cultural control, such as timing of crop harvest to limit insect attack; crop management practices, such as varietal selection; biological control, involving conservation of existing natural enemies of pests; host-plant resistance; and selected use of insecticides.

Although most of the management tools are usually available, pesticides or chemicals remain the most widely used control tool. Major factors to be considered when using insecticides include: 1) protection of natural enemies of crop pests, 2) resurgence of primary insect or mite pests and increased numbers of secondary insect pests following application, and 3) insect resistance to insecticides. Apply insecticides at the proper rates only when field inspection counts justify the need to prevent economic losses from damaging pests.

*Extension entomologist, Fort Stockton, and Extension entomologist and project group supervisor, College Station, The Texas A&M University System.

INSECTICIDE APPLICATION

Ground machines and aircraft may be used to apply most insecticides. For best results with aerial applications, flag the swaths to meet or overlap. Spray applications are most effective and drift hazard minimized when wind velocity does not exceed 10 miles per hour. Avoid spraying when plants are wet and when daytime temperatures do not exceed 70 degrees F.

Nozzle size and number, ground speed and pressure influence the rate of insecticide output per acre. The sprayer should be carefully calibrated to insure proper application of suggested insecticide rates. Plant coverage by a particular insecticide is essential for optimum insect or mite control. Use of excess insecticide may result in residue accumulation, possible injury to the plants and an increase in production cost. Extremely low rates may result in poor control.

Proper sprayer calibration and nozzle action/placement will assure adequate spray volume, good foliar coverage and application of the required rate of toxicant. Refer to L-764 *Pesticide Application Ground Equipment Calibration Guide* for additional information.

POLICY FOR MAKING INSECT CONTROL SUGGESTIONS

Suggestions on pesticide use made by the Texas Agricultural Extension Service and the Texas Agricultural Experiment Station are based upon:

- Effectiveness under conditions in various locations in Texas
- Avoidance of residues in excess of allowable tolerances
- Avoidance of adverse side effects upon beneficial predators, parasites, honey bees, fish and other wildlife, plants, animals and humans
- Relative toxicity to humans, animals and desirable vegetation

Suggested pesticides must be registered and labeled for use by the U.S. Environmental Protection Agency and/or the Texas Department of Agriculture. The status of pesticide label clearances is subject to change, and may have changed since this publication was printed. County Extension agents and specialists are advised of changes as they occur.

The USER is responsible for the damaging effects of pesticide residues on his livestock and crops, as well as problems that could arise from drift or movement of the pesticide from his property to that of others. ALWAYS READ AND FOLLOW CAREFULLY THE INSTRUCTIONS ON THE CONTAINER LABEL.

Proper disposal of waste pesticides and "empty" or used containers is an essential step in safe pesticide use. For additional information, see L-1008 *Disposal — Pesticide and Pesticide Containers*.

Where information is available, *action levels* for insect control have been indicated in this publication. Action levels are guidelines that will vary, depending on stage of crop development, growing conditions, value of the crop and other factors.

For further information, contact your county Extension agent, Extension agent-entomology, Extension entomologist or Extension agricultural chemist at Texas A&M University (713/845-3849).

PROTECTING BEES AND OTHER POLLINATORS FROM INSECTICIDES

Pollination is extremely important in the production of many seed crops. This is particularly true of legumes such as alfalfa, clovers and vetch. Most grass-type plants are wind- or self-pollinated and do not require the assistance of insect pollinators. Where pollen-collecting insects are required for flower fertilization, the producer, insecticide applicator and beekeeper should cooperate closely to minimize losses of bees. The following guidelines will avoid or reduce bee losses:

1. Apply insecticides, if practical, *before* bees are moved into fields for pollination.
2. When insecticides are needed, use materials least toxic to bees.
3. Make all applications late in the evening (6 to 7 p.m.) when bees are not visiting the field. EVENING APPLICATIONS AFTER BEES HAVE LEFT THE FIELD ARE LESS HAZARDOUS THAN EARLY MORNING.
4. Use spray or granular formulations rather than dusts.
5. Where it is necessary to use one of the insecticides in Groups 1 or 2 in the following list, notify the beekeeper so that he can make necessary arrangements to protect his bees.

6. Avoid drifting or spraying an insecticide directly on colonies. Heavy losses generally occur in these situations. On hot evenings, bees often cluster on the front of the hives. Pesticide drift or direct spray at this time generally results in heavy mortality.

INSECTICIDES USED ON ALFALFA, CLOVER, FORAGE SORGHUM, VETCH, AND PASTURE PESTS GROUPED ACCORDING TO RELATIVE HAZARDS TO HONEY BEES

Insecticides	Remarks
GROUP 1. Highly Toxic Azinphosmethyl (Guthion®) Carbaryl (Sevin® sprayable, Sevimol® 4, Sevin® XLR) Carbofuran (Furadan®) Diazinon Dimethoate (Cygon®, Defend®) Fensulfothion (Dasanit®) Malathion (wettable powder or ULV) Methidathion (Supracide®) Methomyl (Lannate®, Nudrin®) Methyl parathion Naled (Dibrom®) Parathion Phosmet (Imidan®)	This group includes materials that kill bees on contact during application or for several days. With some exceptions, bees should be removed from the area if these materials are used on plants being visited by the bees. Because of short residual activity, naled can be applied to the crops when bees are not foraging. **Malathion** occasionally causes heavy bee losses, particularly during periods of extremely high temperatures. *Application of malathion should be made in the evening after all bees have completed foraging.* Ultra low-volume malathion applications should be avoided after blooms appear. Granular insecticide formulations pose far less hazard because of the potential for pollinator/pesticide contact. This is particularly true of soil-applied granular formulations. Foliar applications of these same formulations would pose an intermediate hazard.
GROUP 2. Moderately Toxic Carbophenothion (Trithion®) Disulfoton (Di-Syston®) Malathion (EC) Methoxychlor Phorate (Thimet®)	Do not apply when bees are working in field. *Apply in late evening.*
GROUP 3. Relatively Nontoxic *Bacillus thuringiensis* (Dipel®, Thuricide®, Bactur®) Demeton (Systox®) Methoxychlor Toxaphene Trichlorfon (Dylox®)	These materials are the least toxic to bees. *Applications should be made in late evening when bees are not foraging.*

PRECAUTIONS

Certain insecticides discolor the foliage of certain sorghum varieties. Stunting and foliage burn have resulted from the use of specific chemicals on certain sorghum hybrids. Before application, growers should closely check the insecticide label, the manufacturer and the seed company regarding possible phytotoxic effects.

ALFALFA AND CLOVER PESTS

A large variety of insects are found in alfalfa and clover. Many of them are not injurious. Some are only visitors or may be feeding on other plants scattered in the alfalfa or clover fields; others are present in small numbers and do not cause economic damage; many are beneficial. Beneficial insects include the insect pollinators, parasites and predators that tend to keep insect pest numbers below economic levels. However, several insect pests are injurious. These pests feed on the leaves, stems, crowns, seed pods and flowers resulting in foliage and/or seed yield loss.

Field Scouting

Fields of alfalfa or clover grown for hay or grazing should be checked weekly during the production season for insect activity. Fields grown for seed production should be checked at least weekly until buds begin to form; then twice each week from bud stage until seed harvest.

A standard 15-inch diameter sweep net is the basic sampling tool used in alfalfa and clover fields. A sampling unit consists of 10 consecutive (180 degree) sweeps taken while walking through the field. The net is swung from side to side with each step. The net should be held so the lower half of the opening (7 to 8 inches) is drawn through the foliage. If foliage and stems are not obtained in the sample, the net is not being swung hard enough and/or deep enough. Samples may differ somewhat among individuals according to their reach.

Five samples (each consisting of 10 sweeps) taken on each side of the field and one near the center of the field provide a good estimate of insect numbers. Each sample should be taken 30 to 50 feet from each edge of the field. The sample size should be increased to 10 in fields with 100 acres and to the equivalent of one unit per 10 acres for uniform fields of 200 acres or more.

A sweep net can be used to sample a field for aphids. Often aphids are too abundant to count individually but can be estimated in 10's or 100's.

Aphid counts also may be obtained by cutting stems with a knife near ground level, gently lifting them out of the foliage, inverting them and counting the aphids on the stems and undersides of the leaves.

Sucking Pests

Pea Aphid. Pea aphid adults are bright green, long-legged and about ⅛-inch long. Adults may be

winged or wingless. Pea aphids generally cause the greatest amount of damage in the spring and early summer and then again in the fall.

Pea aphids prefer to congregate in dense colonies along the stems, terminal shoots and leaves. Heavy infestations cause plants to wilt and turn yellowish-green. Honeydew is usually not abundant on infested plants.

Spotted Alfalfa Aphid. The spotted alfalfa aphid is small (1/16 inch in body length) and grayish-yellow with four to six rows of raised dark spots on the back. This aphid is usually found on the undersides of lower leaves. However, as the population increases, aphids can be found on all parts of the plant. Spotted alfalfa aphids secrete large amounts of honeydew and will fall from alfalfa plants when disturbed.

Infestations can increase rapidly under favorable conditions. However, rain and high humidity often reduce an infestation or create conditions unfavorable for survival.

When feeding, the spotted alfalfa aphid secretes a toxin that causes considerable plant injury and even death of seedling alfalfa. On established stands, growth will be severely stunted where yellow or chlorotic areas appear on the leaves.

Blue Alfalfa Aphid. The blue alfalfa aphid was detected in fields in West Texas in 1978 but as of this printing has been of no economic importance. The pest closely resembles the pea aphid but is bluish-green rather than yellowish to light green. The blue aphid tends to congregate in clusters on the terminal growth while the pea aphid may be found over the entire plant. The blue aphids build up to high populations in the early spring, but populations decline when temperatures get above 85 degrees F. Severe stunting of plants and yellowing of leaves may result from blue aphid feeding on new alfalfa regrowth less than 6 inches tall and when temperatures are below 75 degrees F.

Action Levels for Aphid Control	
Pea aphid	When counts in established stands average 10 to 15 aphids per stem or 150 aphids per plant or when plants begin to show signs of stress from feeding activity of the aphids.
Spotted alfalfa aphid	When 20 to 40 wingless aphids are found per stem on established stands or when honeydew first begins to make plants sticky. Seedling stands should be treated when aphids are first observed in small numbers. An average of one spotted aphid per plant in seedling stands may result in complete stand loss.

Blue alfalfa aphid

When 10 to 12 aphids are found per stem on new regrowth in February and March. When alfalfa is more than one-half grown (10 to 15 inches stem length), plants can withstand 40 to 50 or more aphids per stem with little or no loss in yield.

SUGGESTED APHID CONTROL ON ALFALFA AND CLOVER
Pea, Spotted Alfalfa, Yellow Clover, Blue Alfalfa

Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to: Harvest	Grazing
Demeton		15	--
(Systox®, 2 lb.)	1-2 pt.	See remarks.	
(Systox®, 6 lb.)	⅓-⅔ pt.		
Diazinon (4 lb.)	¾-1 pt.	7	7
		See remarks.	
Diazinon + methoxychlor		7	7
(Alfa-tox®, 0.84 + 1.6 lb.)	2-3 qt.	See remarks.	
Dimethoate		10	10
(Cygon®, 4 lb.)	½-1 pt.	See remarks.	
(De-Fend®, 2.67 lb.)	¾-1½ pt.		
Disulfoton (Di-Syston®, 15% G)	6.7 lb.		
	(alfalfa)	0	0
	(clover)	7	7
		See remarks.	
Malathion		0	0
(Cythion®, 5 lb.)	1½ pt.	See remarks.	
Methidathion		10	10
(Supracide®, 2 lb.)	2-4 pt.	See remarks.	
Methyl parathion (4 lb.)	½ pt.	15	15
Parathion (4 lb.)	½ pt.	15	15
Parathion (8 lb.)	¼ pt.	15	15

Remarks

Treat when temperatures are above 50 degrees F.

Demeton. Apply only to alfalfa or clover seed crops. Do not cut green crop for feed or forage.

Diazinon. Do not apply to alfalfa in bloom. Remove livestock from field during application.

Diazinon + methoxychlor. Do not apply during bloom. Remove livestock from field during application.

Dimethoate. Make only one application per cutting. Do not apply to alfalfa in bloom period. Not labeled for use on clover.

Disulfoton. Apply by broadcast treatment as needed. Allow a minimum of 28 days between application.

Malathion. Do not apply when plants are in bloom. Do not use on seed alfalfa.

Methidathion. Make only one application per alfalfa cutting. Do not apply during alfalfa bloom. Do not use on clover.

Aphid-Resistant Alfalfa Varieties. The planting of aphid-resistant alfalfa varieties has been the most effective means of pest management for the spotted alfalfa aphid and pea aphid. Growers should determine which resistant variety is best suited for hay and seed production in their area. Do not select a variety only on its aphid resistance characteristic. Growers should consult their county Extension agent for assistance in selecting adapted, aphid-resistant alfalfa varieties.

Lygus Bugs (Lygus spp.). Lygus bugs are often serious pests of alfalfa and clover being grown for seed, but are not considered major pests of hay crops. Heavy infestations cause blasted buds, blossom drop and shriveled seed. Greatest damage is caused when lygus bugs feed on the buds. Injured buds turn tan to white, die and fall from the plant within a few days.

A sweep net should be used to collect lygus bugs for field counts. Field sampling should be done during the early morning or late afternoon when wind velocity is less than 10 miles per hour. This sampling period is suggested because lygus bugs are difficult to sample during periods of high winds and high temperatures.

Action level should be based on sweep net counts and stage of seed crop maturity.

Action Levels for Lygus Bug Control

Seed Crop Maturity Stage	Number Lygus per 100 sweeps exceed (count each nymph as 2)
Green Bud	75
Bloom	100
Soft-dough	120-150

SUGGESTED LYGUS CONTROL ON ALFALFA AND CLOVER SEED CROPS

Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to: Harvest	Grazing
	Green-bud Stage		
Carbaryl			
(Sevin® Sprayable, 80% SP)	1¼-1⅞ lb.	0	0
(Sevimol® 4,4 lb.)	1-1½ qt.	0	0
(Sevin® XLR, 4 lb.)	1-1½ qt.	0	0
Carbofuran			
(Furadan®, 4 lb.)	2 pt.	28	28
		See remarks.	

Dimethoate			
(Cygon®, 4 lb.)	1 pt.	10	10
(DeFend, 2.67 lb.)	1½ pt.	10	10
		See remarks.	
Diazinon + methoxychlor			
(Alfa-tox®, 0.84 + 1.6 lb.)	2½-3 qt.	7	7
		See remarks.	
Methyl parathion (4 lb.)	1 pt.	15	15
Parathion (4 lb.)	1 pt.	15	15
Parathion (8 lb.)	½ pt.	15	15
Trichlorfon			
(Dylox®, 80% SP)	1¼ lb.	0	0
		See remarks.	
(Dylox® Liquid Solution, 4 lb.)	2 pt.	0	0
		See remarks.	
Bloom to Soft Dough Stage			
Trichlorfon			
(Dylox®, 80% SP)	1¼ lb.	0	0
		See remarks.	
(Dylox® Liquid Solution, 4 lb.)	2 pt.	0	0
		See remarks.	

Remarks

Carbofuran. Do not apply more than once per season. Treat alfalfa prior to bloom. Do not move bees into alfalfa field within 7 days of application.

Diazinon + methoxychlor. Do not apply to alfalfa in bloom. Remove livestock from methoxychlor field during application.

Dimethoate. Do not apply to alfalfa during bloom stage. Not labeled for use on clover.

Trichlorfon. Three applications may be made per cutting, with the last application up to the day of cutting. Use immediately after mixing. Avoid using alkaline water as carrier or add a buffering agent to reduce the pH into the acid range.

Stink Bugs. Stink bugs may cause extensive damage to alfalfa and clover seed crops. They often move into fields in large numbers soon after pods begin to form. The most serious damage is caused when they suck juices from the immature seed. The damaged seeds then collapse into flattened shells that soon shrivel, dry and turn brown.

A sweep net should be used to collect stink bugs to determine when they are abundant enough to warrant control.

Action level is an average of 8 to 12 adults and nymphs per 100 net sweeps in late bloom fields when there are numerous maturing seed pods present.

SUGGESTED STINK BUG CONTROL ON ALFALFA AND CLOVER SEED CROPS

Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to: Harvest	Grazing
Carbaryl			
(Sevin® Sprayable, 80% WP)	1¼-1⅞ lb.	0	0
(Sevimol® 4, 4 lb.)	1-1½ qt.	0	0
(Sevin® XLR, 4 lb.)	1-1½ qt.	0	0
Trichlorfon			
(Dylox®, 80% SP)	1¼ lb.	0	0
		See remarks.	
(Dylox® Liquid Solution, 4 lb.)	2 pt.	0	0
		See remarks.	

Remarks

Trichlorfon. Three applications may be made per cutting with the last application up to day of cutting. Use immediately after mixing. Avoid using alkaline water as carrier or add a buffering agent to reduce the pH into the acid range.

Threecornered Alfalfa Hopper. Threecornered alfalfa hoppers are commonly found in alfalfa and clover fields. Adults and nymphs suck plant juices by puncturing stems either randomly or in a regular circle that completely girdles a stem. Most of the girdling is done by the nymphs. Girdled stems become stunted, crown dry and then break and lodge.

Make field collections with a sweep net and counts. Check crowns closely for nymphs. Action level in alfalfa and clover crops grown for hay is when nymphs average 25 to 30 per crown. Examine plant crowns at several locations over the field. For seed crops, the action level is reached when sweep net counts average 150 or more per 100 sweeps.

SUGGESTED THREECORNERED ALFALFA HOPPER CONTROL IN ALFALFA AND CLOVER

Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to: Harvest	Grazing
Carbaryl			
(Sevin® Sprayable, 80% SP)	1¼ lb.	0	0
(Sevimol® 4, 4 lb.)	1 qt.	0	0
(Sevin® XLR, 4 lb.)	1 qt.	0	0
Malathion		0	0
(Cythion®, 5 lb.)	1½ pt.	See remarks.	
Parathion (4 lb.)	½ pt.	15	15
Parathion (8 lb.)	¼ pt.	15	15

Remarks

Malathion. Do not apply to clover or alfalfa in bloom. Do not apply to seed clover or alfalfa.

Thrips. Thrips feed on alfalfa blooms, buds and leaves. When feeding is severe, leaves become distorted and silvered, and blooms turn a mottled brown. *The effect of this damage on alfalfa seed production has not been determined and no control methods or action levels have been developed.*

Chewing Pests

Alfalfa Seed Chalcid. The alfalfa seed chalcid is a small (1/12-inch long), jet-black wasp that usually deposits one egg per immature alfalfa seed. The developing larva hollows out the seed. Infested seeds are plump and light brown, while uninjured seeds have a healthy-green appearance before they are mature. Populations of chalcids increase from spring through late summer. Consequently, late-season seed often is more severely attacked. *Chemical control is not recommended for the alfalfa seed chalcid*. The following cultural practices are effective in reducing chalcid populations and damage:

- Manage the crop so that it matures uniformly and as early as possible.
- Keep field margins, borders and ditch banks free of volunteer alfalfa that may produce seed. (The chalcid overwinters as a mature larva in seed.)
- Destroy before spring all chaff and screenings from the previous year.
- Harrow or disk seed fields in the fall or bury infested seed. In the western areas of Texas, an irrigation following the harrowing or disking will greatly aid in decomposition of plant debris and germination of seed shattered at harvest.

Army Cutworm. There is only one generation per year of the army cutworm. The insect overwinters as an immature larva. In the spring the larvae feed and complete their development. Larvae feed on a variety of plants, although alfalfa and winter wheat are the principal crops damaged.

Female moths lay eggs in the fall on the soil surface. Moisture is required for the eggs to hatch. Young larvae pass the winter hibernating in the soil. As the weather warms during the day in late winter and spring, the young larvae resume their feeding and growth. Mature larvae are about 1- to 1½-inches long, pale greenish-gray to brown, with the back pale-striped and finely mottled with white and brown.

The army cutworm feeds entirely above the soil surface. Larvae prefer to feed on plant leaves and only eat stems and other plant parts when food is scarce. Feeding occurs from late afternoon until dark on most days. When the temperature is relatively high, the larvae hide under clods and in the soil during hours of bright sunshine. On dark cloudy days, the larvae often feed both day and night. Army cutworms can cause heavy damage to newly planted stands of alfalfa.

Action level is 3 to 4 larvae, ½ inch or less in length, per square foot or 2 to 3 larvae more than ½ inch in length per square foot.

SUGGESTED ARMY CUTWORM CONTROL ON ALFALFA AND CLOVER

Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Carbaryl			
(Sevimol® 4, 4 lb.)	1-1½ qt.	0	0
(Sevin® Sprayable, 80% SP)	1¼-1⅞ lb.	0	0
(Sevin® XLR, 4 lb.)	1-1½ qt.	0	0

Alfalfa Weevil. The alfalfa weevil is primarily a pest of alfalfa but may attack several species of clover. Adults and larvae feed on alfalfa leaves and buds. The first and second alfalfa cuttings are most heavily damaged. Upon hatching, larvae feed on leaf buds, usually at the tip of the plant. Older larvae feed mostly on open leaflets, but they also will feed on the terminal buds. Foliage is skeletonized by alfalfa weevil larvae and appears grayish to whitish in color.

Adult weevils which become active in late fall and early spring enter alfalfa fields to begin laying eggs inside alfalfa stems. Activity ceases during the winter. Fall-laid eggs begin to hatch in early spring; spring-laid eggs hatch after being exposed to a few days of warm temperatures. Eggs hatch into small, light green, black headed larvae. Young larvae are yellowish green in color and mature larvae are darker green with a white stripe extending down their backs. Larvae feed for about 3 to 4 weeks on the terminal and upper leaves. In fields where infestations arise from both fall- and spring-laid eggs, feeding damage from this insect pest is extended over a period of 6 to 8 weeks. Extent of crop damage caused by alfalfa weevil larvae depends on: 1) the size of the alfalfa plant, 2) the size of the larvae and 3) the number of larvae per alfalfa stem.

When larvae are mature, they spin cocoons about ¼ inch in diameter either on the plants or within the curl of fallen, dead leaves. They pupate within these cocoons and emerge as adults in 1 to 2 weeks. After emergence, most young adults leave the alfalfa field and go to nearby protected areas to hibernate during the summer.

Once an alfalfa field becomes infested with alfalfa weevil, damage usually occurs year after year. Crop production practices that encourage dense, vigorous plant growth will reduce weevil damage. The first crop should be cut as cleanly and closely as possible when most of the plants are in the bud stage. This deprives the larvae of food and shelter. Exposure of the larvae to the sun is usually fatal.

In fields where fall-laid eggs are present, grazing, burning (where enough old growth remains on the field), flaming or crushing the stems with a heavy roller during the months of December, January and February will aid in destruction of these eggs.

Close field inspections are necessary to determine when the action level has been reached.

Action level should be based on plant size, plant damage and number of weevil larvae. The following table will serve as a general guide in determining the action level:

Action Level for Alfalfa Weevil

Crop Growth Stage	Action Level
Early spring when alfalfa stems are 2 to 6 inches in height	When two or more larvae are found per plant terminal or when 30 to 50 percent of plant terminals show weevil feeding damage.
When plant stems are 7 to 14 inches in height	When 20 or more weevil larvae per net sweep are found, when 25 to 30 percent of plant stem terminals show weevil feeding damage or when 25 or more weevil larvae per square foot are present.
Close to the cutting stage[1]	When the top 3 inches of plant stem terminals on majority of plants are being damaged by weevil larvae.
Stubble (after first cutting)[2]	When high numbers of weevil larvae or newly-emerged adult weevils are present at time of first cutting.

[1]In alfalfa within 2 weeks of cutting, it may be advisable to cut early rather than apply an insecticide.

[2]Stubble treatment would be advisable if cloudy conditions and mild temperatures prevail and if weevil larvae appear to remain in abundant numbers under the hay in the windrow.

SUGGESTED ALFALFA WEEVIL CONTROL ON ALFALFA

Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to: Harvest	Grazing
Azinphosmethyl (Guthion®, 2 lb.)	2 pt.	16 See remarks.	16
Carbaryl (Sevin® Sprayable-80% SP)	1-1½ lb.	0	0
(Sevimol® 4, 4 lb.)	1-1½ qt.	0	0
(Sevin® XLR, 4 lb.)	1-1½ qt.	0	0
Carbofuran (Furadan®, 4 lb.)	1-2 pt.	28 See remarks.	28
Diazinon (4 lb.)	2-3 pt.	10 See remarks.	2
Diazinon + methoxychlor (Alfa-tox®, 0.84 + 1.6 lb.)	2-3 qt.	7 See remarks.	7
Malathion (Cythion®, 5 lb.)	2 pt.	0	0
(Malathion ULV®, 9.33 lb.)	16 fl. oz.	5 See remarks.	5
Methidathion (Supracide®, 2 lb.)	2-4 pt.	10 See remarks.	10
Methoxychlor (2 lb.)	4-6 pt.	7	7
Methyl parathion (4 lb.)	¾ pt.	15	15
Parathion (4 lb.)	½-1 pt.	15	15
Phosmet (Imidan®, 50% WP)	2 lb.	7 See remarks.	7

Remarks

Azinphosmethyl. Apply only once per alfalfa cutting.

Carbofuran. Do not apply more than once per season. Apply only to pure stands of alfalfa.

Diazinon. Do not apply to alfalfa in bloom. Remove livestock from field during application.

Diazinon + methoxychlor. Do not apply during bloom. Remove livestock from field during application.

Malathion. Do not apply when plants are in bloom. Do not use on seed alfalfa.

Methidathion. Only 1 application per alfalfa cutting. To avoid injury to pollinating insects, do not apply during bloom.

Phosmet. Do not apply more than once per cutting.

Clover Head Weevil. The clover head weevil, crimson clover's number one insect enemy, was first observed in Texas in light, scattered infestations during the spring of 1965. It now occurs in all eastern and northeastern Texas counties where crimson clover is grown. Since crimson clover produces only one crop of seed annually, the economic importance of this pest becomes obvious. Producers have also observed

the loss of clover stands in pastures where clover head weevil infestations occurred the previous year. This weevil prefers clovers, particularly crimson, alsike and red; however, the adults have been observed on alfalfa, black medic and snap beans.

Adults become active in early spring and begin egg laying in late March or early April. Each female deposits 200 to 300 eggs in stalks or petioles of host plants during a 2- to 6-week period. Eggs hatch in 5 to 8 days and emerging larvae feed primarily in the florets. Larval populations normally reach a peak around April 15 to May 1. Full-grown larvae are about ½-inch long, legless and vary in color from light green to yellowish. Mature larvae spin a silken cocoon in the floral head of host plants where they spend several days before pupating, a stage requiring 3 to 6 days. The life cycle requires 22 to 28 days from egg to adult. Adults are inactive during the remainder of the summer. They hibernate in ground trash and clump grasses in or near clover fields.

Principal damage is caused by larvae feeding on developing flowers and seed pods. Some damage is also caused by adults feeding on stems, often resulting in lodging of the flowers.

Action level is based on history of damage in the field in previous years plus presence of weevils at beginning of bloom period. Apply treatment when clover has reached a 25 to 50 percent bloom stage. If a second application is required, apply 7 to 10 days after the first.

SUGGESTED CLOVER HEAD WEEVIL CONTROL ON CLOVER

Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Carbaryl (Sevin® Sprayable, 80% SP)	1¼-1⅞ lb.	0	0
(Sevimol® 4, 4 lb.)	1-1½ qt.	0	0
(Sevin® XLR, 4 lb.)	1-1½ qt.	0	0
Methyl parathion (4 lb.)	1 pt.	15	15
Parathion (4 lb.)	1 pt.	15	15
Parathion (8 lb.)	½ pt.	15	15

Alfalfa Caterpillar. The alfalfa caterpillar is the worm (larval) stage of a yellow butterfly that has a 2-inch wingspan and black margins on wings. The yellow butterflies are seen actively flying through the

fields in late spring and summer months. Mature worms are about 1½ inch long and are dark, velvety-green in color, with a white stripe along each side. Worms feed on foliage and numbers usually increase when not held in check by disease or beneficial insects and spiders.

The alfalfa caterpillar usually becomes a pest after the second alfalfa hay cutting. Crop damage can sometimes be avoided by early cutting.

Action level is 7 to 10 worms net count per sweep.

SUGGESTED ALFALFA CATERPILLAR CONTROL ON ALFALFA

Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Bacillus thuringiensis (Dipel®, Thuricide®, Bactur®, etc.)	⅛-¼ lb.	0	0
Carbaryl			
(Sevin® Sprayable, 80% SP)	1¼ lb.	0	0
(Sevimol® 4, 4 lb.)	1 qt.	0	0
(Sevin® XLR, 4 lb.)	1 qt.	0	0
Diazinon + methoxychlor			
(Alfa-tox®, 0.84 + 1.6 lb.)	2½-3 qt.	7	7
		See remarks.	
Methyl parathion (4 lb.)	⅔-¾ pt.	15	15
Parathion (4 lb.)	⅔-¾ pt.	15	15
Trichlorfon			
(Dylox®, 80% SP)	7½-10 oz.	0	0
		See remarks.	
(Dylox® Liquid Solution, 4 lb.)	¾-1 pt.	0	0
		See remarks.	

Remarks

Diazinon + methoxychlor. Do not apply during bloom. Remove livestock from field during application.

Trichlorfon. Three applications may be made per cutting with the last application up to day of cutting. Use immediately after mixing. Avoid using alkaline water as carrier or add a buffering agent to reduce the pH into the acid range.

Armyworms and Corn Earworms. Armyworms are the immature stages of dull-colored, night-active moths. Armyworms range in color from pale green to brown or black and are often striped with white to yellowish lines from head to tail.

The true armyworm, fall armyworm and beet armyworm are commonly found on alfalfa and clover crops and may develop into damaging numbers requiring chemical control. The yellow-striped armyworm is an occasional pest in alfalfa. Infestations of armyworms usually occur in weedy spots in fields.

Corn earworm moths are about ¾-inch long, rather robust, with a wing span of 1 to 1½ inches and range in color from olive green, tan to dark reddish brown. Young larvae are greenish with black heads. Fully-developed worms are about 1½-inches long and range in color from pale green or pinkish to brown.

Earworm larvae feed on numerous plants. In alfalfa, larvae seem to prefer feeding on plant leaves but will feed on other plant parts.

Earworms may be present in alfalfa hay crops throughout the growing season, but usually are more abundant in the months of July through September.

Action level is an average worm count of two or more per net sweep or 25 to 30 percent of stem terminals showing feeding damage.

Action level for armyworms in seedling alfalfa is one or two worms per square foot.

SUGGESTED ARMYWORM AND CORN EARWORM CONTROL ON ALFALFA AND CLOVER

Fall Armyworm, True Armyworm, Beet Armyworm,[1] Yellow-Striped Armyworm, Corn Earworm

Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to: Harvest	Grazing
Carbaryl			
(Sevin® Sprayable, 80% SP)	1¼-1⅞ lb.	0 See remarks.	0
(Sevimol® 4, 4 lb.)	1-1½ qt.	0 See remarks.	0
(Sevin® XLR, 4 lb.)	1-1½ qt.	0 See remarks.	0
Diazinon + methoxychlor			
(Alfa-tox®, 0.84 + 1.6 lb.)	2½-3 qt.	7 See remarks.	7
Malathion			
(Cythion®, 5 lb.)	1 qt.	0	0
(Malathion ULV®, 9.33 lb.)	16 fl. oz.	5 See remarks.	5
Methyl Parathion (4 lb.)	1-1½ pt.	15	15
Methomyl			
(Lannate®, 90% SP)	½-1 lb.	--	7
(Lannate®, 1.8 lb.)	1-2 qt.	--	7
(Nudrin® 1.8, 1.8 lb.)	1-2 qt.	--	7
(Nudrin® 90, 90% SP)	½-1 lb.	-- See remarks.	7
Parathion (4 lb.)	1-1½ pt.	15	15
Parathion (8 lb.)	¾-1 pt.	15	15
Trichlorfon			
(Dylox®, 80% SP)	10-20 oz.	0 See remarks.	0
(Dylox® Liquid Solution, 4 lb.)	1-2 pt.	0 0 See remarks.	0 0

[1]Where beet armyworms make up all or the majority of the pest population, methomyl is recommended for effective control.

Remarks

Carbaryl. Do not use for beet armyworm control.

Diazinon + methoxychlor. Do not apply during bloom. Remove livestock from field during application.

Malathion. Do not apply to seed alfalfa.

Methomyl. Labeled for control of armyworms on alfalfa. Do not apply to dormant or semi-dormant alfalfa when minimum daily temperature is 50 degrees F. or lower. Do not apply during bloom or when bees are present in field.

Trichlorfon. Do not use for corn earworm control. Three applications may be made per cutting, with the last application up to the day of cutting. Use immediately after mixing. Avoid using alkaline water as carrier or add a buffering agent to reduce the pH into the acid range.

Webworms. Webworms are worm stages of small, buff-yellow to brown-colored moths (1-inch wing span). The alfalfa webworm, the garden webworm and the beet webworm are general feeders on alfalfa, clover, cowpeas, peas and similar crops. They also feed on several weed species, especially pigweed. The larvae of all three species web tops of plants and feed within the web, completely skeletonizing the leaves and stems. Flimsy webs near the plant terminals are noticeable in alfalfa and clover crops infested with these insects. Webworms occasionally cause serious damage to alfalfa, particularly to the second and third cuttings.

On alfalfa hay crops, early harvest is suggested if the infested crop is near the cutting stage.

Action level is when the crop is more than 2 weeks from cutting and 25 to 30 percent of plant terminals are infested.

SUGGESTED WEBWORM CONTROL ON ALFALFA AND CLOVER

Alfalfa Webworm, Beet Webworm, Garden Webworm

Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to: Harvest	Grazing
Carbaryl			
(Sevin® Sprayable, 80% SP)	1¼-1⅞ lb.	0	0
(Sevimol® 4, 4 lb.)	1-1½ qt.	0	0
(Sevin® XLR, 4 lb.)	1-1½ qt.	0	0
Methyl parathion (4 lb.)	1-1½ pt.	15	15
Parathion (4 lb.)	1-1½ pt.	15	15
Parathion (8 lb.)	½-¾ pt.	15	15
Trichlorfon			
(Dylox®, 80% SP)	10-20 oz.	0	0
(Dylox® Liquid Solution, 4 lb.)	½-2 pt.	0	0
		See remarks.	

Remarks

Trichlorfon. Labeled for alfalfa webworm only. Three applications may be made per cutting, with the last application up to the day of cutting. Use immediately after mixing. Avoid using alkaline water as carrier or add a buffering agent to reduce the pH into the acid range.

Grasshoppers. A number of grasshopper species may cause damage to alfalfa or clover. These pests generally migrate into the field from adjoining fence rows, ditch banks, field margins or native pastures. All grasshoppers, nymphs and adults, are foliage feeders and can cause extensive forage loss if the population is high. Grasshoppers may devour the entire plant, including leaves, buds, flowers and young seedpods; but extensive damage is not common.

Grasshopper control should be initiated before the pests move out of hatching areas such as fence rows, ditch banks, weedy fields, etc. Grasshoppers are consistently most damaging in dry years when their food is limited.

Reducing weedy field margins (roadsides and fence rows) will aid in reducing grasshopper numbers since these areas are favored habitats for egg laying and early nymphal feeding.

Chemical treatment is suggested outside field margins in early summer where grasshopper nymphs are abundant. Action level for field infestations is an average of 10 or more grasshoppers per square yard.

SUGGESTED GRASSHOPPER CONTROL ON ALFALFA AND CLOVER

Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to: Harvest	Grazing
Carbaryl (Sevin® Sprayable, 80% SP)	⅔-1⅞ lb.	0	0
(Sevimol® 4, 4 lb.)	½-1½ qt.	0	0
(Sevin® XLR, 4 lb.)	½-1½ qt.	0	0
Carbofuran (Furadan®, 4 lb.)	¼-½ pt.	7 See remarks.	7
Diazinon (4 lb.)	1 pt.	7	7
Diazinon + methoxychlor (Alfa-tox®, 0.84 + 1.6 lb.)	2½-3 qt.	7 See remarks.	7
Dimethoate (Cygon®, 4 lb.)	½-1 pt.	10	10
(DeFend®, 2.67 lb.)	¾-1½ pt.	See remarks.	
Malathion (Cythion®, 5 lb.)	1½-2 pt.	0	0
(Malathion ULV®, 9.33 lb.)	8 fl. oz.	0 See remarks.	0
Parathion (4 lb.)	½-1 pt.	15	15
Parathion (8 lb.)	¼-½ pt.	15	15

Remarks

Carbofuran. Do not apply more than once per season. Apply only to fields planted to pure stands of alfalfa.

Diazinon. Do not apply to alfalfa in bloom. Do not spray livestock directly with either air or ground equipment.

Diazinon+ methoxychlor. Do not apply to alfalfa in bloom. Do not spray livestock directly with either air or ground equipment.

Dimethoate. Make only 1 application per cutting. Do not apply to alfalfa in bloom. Not labeled for use on clover.

Malathion. Do not apply to alfalfa in bloom. Do not apply to seed alfalfa.

Blister Beetles. Several species of blister beetles may be found in alfalfa fields during the growing season. The beetles range from ½- to more than 1-inch long and are black, gray or brown in color; some species are striped. Adult blister beetles are narrow, cylindrical, rather soft-bodied beetles with heads *rather distinct from the rest of their bodies. Adults* feed on foliage and flowering parts of alfalfa and many other plants. Adult numbers sometimes become very abundant in fields in the months of July and August. Large numbers of adult beetles can strip plants of leaves in a short time.

Most blister beetles produce cantharidin. The level of cantharidin will vary between individual insects of the same species. This blistering agent can cause numerous health problems for most livestock species. Animal reaction depends on the number of beetles consumed. Horses seem to be very sensitive to cantharidin. Research has shown that as few as two to five ingested beetles may cause colic in horses. Hay and feed producers should inspect alfalfa fields for presence of blister beetles before hay is cut, especially during the months of July through September. Fields should be scouted for blister beetles within 2 days of hay harvest. Adult beetles are mobile and will occur in pockets distributed throughout the field. Blister beetle infested areas should be left unharvested or sprayed with an insecticide.

No well-defined action level exists for this insect pest. Therefore, control decisions are a matter of individual judgment related to crop damage and number of beetles in hay crop prior to harvest.

SUGGESTED BLISTER BEETLES CONTROL ON ALFALFA

Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Carbaryl			
(Sevimol® 4, 4 lb.)	½-1 qt.	0	0
(Sevin® Sprayable, 80% SP)	⅔-1¼ lb.	0	0
(Sevin® XLR, 4 lb.)	½-1 qt.	0	0

VETCH PESTS

Sucking Pests

Pea aphids, thrips and *lygus bugs* are insect pests of vetch grown for seed production.

Action level for these insects is when the following activity occurs in a field.

Action Level for Pea Aphids, Thrips and Lygus Bugs

Pest	Action Level
Pea aphids	When visible signs of plant wilting are observed, accompanied by foliage yellowing, honeydew and aphid numbers are increasing.
Thrips	When excessive blasting and shedding of blooms are observed.
Lygus bugs	When lygus average 2 per sweep in bud and early bloom stages.

SUGGESTED APHID, THRIPS AND LYGUS BUG CONTROL ON VETCH

Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Malathion (5 lb.)	1½-2 pt.	0	0
Methyl parathion (4 lb.)	½-1 pt.	15	15
Parathion (4 lb.)	½-1 pt.	15	15
Parathion (8 lb.)	¼-½ pt.	15	15

Chewing Pests

Vetch Bruchid. The vetch bruchid or "vetch weevil" is one of the most damaging pests for the vetch seed producer. Adults are about ⅛-inch long, black with wing covers marked with irregular white colored patches. Larvae are grub-like in appearance, about ⅛-inch long and white to cream in color. Adults feed upon developing flower buds and pollen, but the primary damage is caused by larvae. Larvae consume the contents of the seed and may cause yield losses of 10 to 74 percent. Bruchids do not reproduce in stored vetch seed, although they may be found occasionally inside the seed hull.

Action level for vetch bruchid control is 10 to 25 percent fallen blooms with bruchids present. A sweep net is preferred over individual plant inspection for detection of bruchids. Check fields 6 to 8 days after treatment; if bruchids are still present, repeat application.

SUGGESTED BRUCHID CONTROL ON VETCH

Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to: Harvest	Grazing
Malathion (5 lb.)	1½-2 pt.	0	0
Methyl parathion (4 lb.)	½-1 pt.	15	15

Armyworms and Cutworms. Armyworms and cutworms may occur in damaging levels in fields of vetch or vetch planted with a small grain crop. *Armyworms and cutworms should be controlled when visible foliage loss occurs*.

SUGGESTED ARMYWORM AND CUTWORM CONTROL ON VETCH

Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to: Harvest	Grazing
Methyl parathion (4 lb.)	½-1 pt.	15	15

FORAGE SORGHUM PESTS

Soil Pests

True and false wireworms, white grubs, corn rootworms, cutworms and seed corn maggots are the most common soil pests of sorghum in Texas. Non-crop plant materials are important food sources for soil pests. Cultivation practices and/or the use of herbicides that reduce crop residues and provide for weed-free fields are important in reducing soil pest numbers. Proper seedbed preparation that provides for rapid seedling emergence and establishment and preplant soil inspection for the presence of soil pest populations are important. If damaging soil pest numbers are present, approved insecticides may be applied to the seed prior to planting or to the soil using the broadcast, rowband or in furrow method of application. Preplant seed treatment or planter box treatment has proved effective in controlling wireworms, seed corn maggot and seed corn beetle. Moderate to high populations of white grub and corn rootworm require broadcast or band application of effective insecticides. Effective control of high white grub population often requires a broadcast application.

Treatment Methods

Seed Treatment. On-farm seed treatment can be

accomplished by using a concrete mixer, custom-designed seed treatment equipment or other similar seed treatment devices. Seed should be evenly coated with insecticide. Sprinkle 1 pint of water on each 100 pounds of seed and mix to evenly coat the seed with moisture. Add the correct amount of insecticide to the seed as specified by the pesticide label and mix thoroughly. Suggested seed treatment insecticides are heptachlor and lindane. Follow recommendations on insecticide label to achieve effective control. Lindane is phytotoxic on sorghum seed and will adversely affect germination. *Do not treat seed more than 3 to 4 weeks prior to planting where lindane is used.*

Insecticides such as *malathion* or *methoxychlor* are often applied to seed to control stored grain pests. These insecticides are not effective for the control of soil pests.

Planter Box Treatment. Some insecticides are formulated to be applied to seed in the planter box. This method is effective only against those pests and their population levels which can be controlled effectively by direct-seed treatment. Use this soil insect control technique in strict accordance with recommendations on the insecticide label. Insecticides suggested for use in planter box treatment include lindane, diazinon or a combination of lindane plus diazinon.

Uniform distribution of insecticides on the seed in the planter box is important. Avoid contact of insecticides with the skin and eyes and/or breathing of insecticide dust.

Soil Treatment. Insecticide application for controlling wireworms, corn rootworms, white grubs and cutworms must be made before the crop is planted or at planting time. Granular, wettable powder or emulsifiable concentrate formulations may be used. The insecticide formulation used usually depends on available application equipment.

Preplant. Soil treatments can be applied before planting. A broadcast application results in the best control of soil insects and is the only means of controlling heavy infestations of white grubs. However, it is more expensive because of the additional insecticide required, compared with a rowband or in-furrow treatment. Apply broadcast applications uniformly to plowed ground and disk immediately to a depth of 3 to 5 inches. Where sorghum is to be planted on beds, special equipment for insecticide incorporation to a depth of 3 to 5 inches is required for preplant soil treatment. This often is referred to as a row-

incorporated treatment. Row treatments must be made after the bed is prepared for planting because any manipulation, such as bed shaping, likely will alter the position of the insecticide in the row. Row or band application can be applied when bed shaping is done. A treated band 7 to 10 inches wide and 3 to 5 inches deep, with seed placed in the center of the treated band, is necessary to obtain maximum control. For narrow-row plantings, use rates recommended on the insecticide label.

At planting time. Insecticides also may be applied to the soil at planting time by the in-furrow technique. This method is less applicable where a bed planter is used because insecticide incorporation within the root zone may defeat major objectives of bed planting. Where bed planting is to be used, soil insecticides may be incorporated in a band when bed shaping is done, as previously described.

With lister or conventional planters, mount spray or granular application equipment on the planter with the nozzle or spout just behind the opening plow and in front of the covering shovels. Adjust nozzles or spouts so that the treatment band is about 7 to 10 inches wide and the seed furrow, as well as the covering soil, is treated. Incorporation accomplished during seed covering generally is adequate. Applying the insecticide directly in the seed furrow and in direct contact with the seed may affect germination. Poor control may result from in-furrow application where pest populations are high.

For specific soil treatment pesticide suggestions, limitations and rate of each insecticide labeled for use on forage sorghums, refer to the insecticide suggestion table, page 27, for white grub control.

Pests

Wireworms. True and false wireworms are the immature stages of click and darkling beetles. Wireworms are generally shiny, slender, cylindrical and hard-bodied. They range in color from yellow to brown.

Wireworms damage forage sorghum by destroying planted seed and, to a lesser degree, by feeding on seedling plant roots. Stand establishment and plant vigor is reduced. Sampling of fields for the presence of wireworms prior to planting is recommended. Soil samples 1 foot square by 4 inches deep should be examined thoroughly. *If two or more wireworm larvae per linear foot are detected, control measures are warranted.*

Cultural practices that reduce non-crop plant

materials in fields or rotation to certain tap-rooted crops that are unfavorable for wireworm development are important non-chemical control methods.

Approved insecticides, applied as seed treatments or planter box treatments, are effective in controlling wireworms. See seed treatment, page 25 for procedures.

White Grubs. White grubs are the larval stages of May or June beetles. Larvae are characteristically "C-shaped" with a white body and tan to brown head. Larvae vary in size according to age and species. The last abdominal segment is transparent, and digested material can be seen in the larvae.

Damage to plants results from larvae feeding on the roots. Small seedlings often are killed, resulting in stand loss. Severely pruned roots of larger plants result in stunting, plant lodging and increased susceptibility to drought conditions and stalk rot organisms.

Action level for white grubs is based on the number of grubs per square foot of soil. Examine one square-foot soil sample for each 5 to 10 acres before planting. An average of one white grub per square foot is sufficient to cause significant stand loss. Where grub numbers are high (approximately two per square foot) seed furrow treatments are not sufficiently effective. Best control results are obtained by broadcasting an approved insecticide to plowed ground before planting, followed immediately by thorough incorporation by disking into the top 3 to 5 inches of soil (see *Soil Treatment*, page 25).

SUGGESTED WHITE GRUB CONTROL ON FORAGE SORGHUM

Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to: Harvest	Grazing
Diazinon (14.3% G or 4 lb.)	7-10 lb. 1½-2 qt.	7 7	7 0
		See remarks.	
Fensulfothion (Dasanit®, 15% G or 6 lb.)	6.5 lb. or 1.7 fl. ozs./ 1,000 ft. of row	0 0	0 0
		See remarks	

Remarks

Diazinon. Preplant broadcast applications are most effective, though soil incorporation is necessary. Do not apply directly to seed. Make application where populations average one grub per square foot of soil.

Fensulfothion. Apply granules in seed furrow at planting as a 2-inch band, ½ inch above seed. Do not apply directly to seed. Apply specified dosage in 20 gallons of water as a 3- to 4-inch band in the seed furrow at planting, ½ inch above seed. Do not apply directly to seed.

Corn Rootworms. Corn rootworms are the immature larval stages of a complex of leaf-feeding beetles. The southern corn rootworm is the most important sorghum pest of the rootworm complex. Rootworms are small, brownheaded, creamy white larvae that burrow into the roots and crowns of sorghum plants. Reduced stand establishment and plant vigor, and the occurrence of dead heart in young plants, are characteristic of rootworm damage. Plant lodging may occur later in the season.

Presently no insecticides are labeled for in-furrow or preplant use for corn rootworm control. Seed treatments with heptachlor or lindane are effective in controlling light infestations of corn rootworms at planting time. See *Seed Treatment*, page 25, for procedures.

Cutworms. A complex of cutworms can damage forage sorghum. Cutworms are the immature stage of moths that are active at night. Grassy sod and weedy fields are attractive to moths for egg laying. Newly-hatched cutworms feed on sorghum seedlings and often clip plants just above the ground level. Some subterranean cutworms feed on the seedling root system. Cutworm infested fields have the appearance of being closely grazed and damage may be clumped or occur in spots of the field. Larval feeding commonly occurs at night.

Cultivation practices and/or the use of herbicides that reduce non-crop plants in-season and in fallowed fields are important cutworm control methods.

Aerial or ground-applied insecticides effectively control cutworms in established forage sorghum stands. Cutworms usually damage forage sorghum only during the seedling stage.

Well defined action levels do not exist for this pest; therefore, control decisions are a matter of individual judgment related to possible stand loss. Insecticides should be applied as a direct spray to the plants and adjacent soil.

SUGGESTED CUTWORM CONTROL ON FORAGE SORGHUM

Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Carbaryl			
(Sevin® Sprayable, 80% SP)	2½ lb.	0	0
(Sevimol® 4, 4 lb.)	2 qt.	0	0
(Sevin® XLR, 4 lb.)	2 qt.	0	0

Above-Ground Pests

Greenbugs. Greenbugs are aphids that suck plant juices and inject toxin into forage sorghum plants. This aphid is pale green, approximately 1/16-inch long with a characteristic dark green stripe on the back.

Greenbugs can cause stand loss, stunting and plant death in forage sorghums. They are not as damaging in forage sorghum as in grain sorghum, principally because of the grazing procedures. However, plant death in the seedling stage may occur and growers should inspect plants frequently during the period from plant emergence until the plants are about 6 to 10 inches tall.

Action level from emergence to about 6 to 10 inches is visible damage (plants beginning to yellow) with greenbug colonies on plants and probable excessive stand loss.

SUGGESTED GREENBUG CONTROL ON FORAGE SORGHUM

Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to: Harvest	Grazing
Attention: Review all remarks below thoroughly.			
Carbophenothion (Trithion®, 8 lb.)	1/5-1/2 pt.	21	21
		See remarks.	
Demeton (Systox®, 2 lb.)	1 pt.	35	35
		See remarks.	
Diazinon (4 lb.)	1/2-1 pt.	7	0
Dimethoate (Cygon®, 4 lb.)	1/2-1 pt.	28	28
(DeFend®, 2.67 lb.)	1/3-1 1/2 pt.	28	28
		See remarks.	
Disulfoton (Di-Syston®, 8 lb.)	4.8 fl. oz.	28	28
(Di-Syston®, 15% G) (whorl application)	6.7 lb.	14	14
		See remarks.	
Parathion (4 lb.)	1/4-1/2 pt.	12	12
Parathion (8 lb.)	1/8-1/4 pt.		
Phorate (Thimet®, 15% G)	5-6.5 lb.	28	28
		See remarks.	

Difficulty in controlling greenbugs has been encountered in several counties of the Texas High Plains. Resistance exists to most registered materials in some localized areas and continued extensive use of insecticides is apt to expand the resistance problem. Where resistance exists in an area, the initial insecticide application should be made at the higher labeled dosage rate. See remarks for use of lower rates.

Remarks

In areas where insecticide resistance has not been observed, effective use of reduced rates is dependent on proper application timing. Reduced rates are designed to suppress greenbug densities below injurious levels while providing maximum protection of beneficial species. Using insecticides to achieve total elimination of greenbugs is not desirable. To conserve beneficial species, a sub-economic greenbug density must be maintained as a food source.

Carbophenothion. Do not apply more than twice per season.

Demeton. Apply only once per season.

Dimethoate. Do not apply more than three times per season.

Disulfoton. Do not apply foliar spray or granules more than three times per crop season. Granular formulation recommended as whorl application only.

Parathion. Do not substitute methyl parathion. Phytotoxicity may be a problem with certain varieties.

Phorate. Whorl application only; only one application per season.

Grasshoppers. A number of grasshopper species are common pests of forage sorghum. These pests generally migrate into the field from adjoining fence rows, ditch banks, field margins or native pastures. All grasshoppers, nymphs and adults, are foliage feeders and can cause extensive forage loss if the pest population is high. An average of six to seven grasshoppers per square yard can consume as much forage as one cow per acre.

Grasshopper control should be initiated before the pests move out of hatching areas, fence rows, ditch banks, weedy fields, etc. Grasshoppers are most damaging in dry years when their food supply is limited.

Action level is 7 to 10 grasshoppers per square yard accompanied by excessive leaf loss.

SUGGESTED GRASSHOPPER CONTROL ON FORAGE SORGHUM

Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Carbaryl			
(Sevin® Sprayable, 80% SP)	⅔-1⅞ lb.	0	0
(Sevimol® 4, 4 lb.)	½-1½ qt.	0	0
(Sevin® XLR, 4 lb.)	½-1½ qt.	0	0
Parathion (4 lb.)	½-¾ pt.	15	15

Remarks

Parathion. Do not substitute methyl parathion. Phytotoxicity may be a problem with certain forage sorghum varieties.

Chinch Bugs (True Chinch Bug). Chinch bugs occasionally damage forage sorghum crops in Texas. The black-bodied, adult chinch bug has reddish-yellow legs and fully developed wings. The mostly

white wings are marked with a triangular black spot at the middle of the outer-wing margin. Immature chinch bugs resemble adults in shape but are reddish in color with a white band across the back.

Adult and immature chinch bugs suck plant juices and cause leaf reddening. Wilting and severe stunting of plants attacked by chinch bugs has been noted from the time of seedling emergence until plants are 18 inches high. Chinch bugs are favored by hot, dry weather and large numbers of immature bugs often migrate from wild bunch grasses or small grains to congregate and feed behind the lower leaf sheaths of sorghum plants.

Action level is two or more adult chinch bugs found on 20 percent of the seedlings less than 6 inches high. Make at least five random checks per field. On taller plants, initiate control when immature and adult bugs infest 75 percent of the plants. When using ground application equipment, insecticide applications should be made with nozzles directed at the infested portion of the plants. To be effective, apply in 20 to 30 gallons of water per acre.

SUGGESTED CHINCH BUG CONTROL ON FORAGE SORGHUM

Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to:	
		Harvest	Grazing
Carbofuran (Furadan®, 4 lb.	½-1 pt.	21	21
Carbaryl (Sevin® Sprayable, 80% SP)	1½-2 lb.	0	0
(Sevin® XLR, 4 lb.)	1-1¾ qt.	0	0
(Sevimol® 4, 4 lb.)	1-1¾ qt.	0	0
Parathion (4 lb.)	½-⅝ pt.	12 See remarks.	12

Remarks

Parathion. Do not substitute with methyl parathion. Phytotoxicity may be a problem with certain forage sorghum varieties.

PERMANENT AND IMPROVED PASTURE PESTS

Grasshoppers, fall armyworms and true armyworms are the most common insect pests of pastures. In some areas of the state, desert termites have become an insect pest problem.

Grasshoppers. Grasshoppers are the most important insect pest of native pasture grasses. Ranchers should closely watch the development of grasshopper populations in the hatching areas during spring and early summer. Insecticides can be most effectively

used in these sites before the grasshoppers have dispersed over large areas. Hoppers will usually start hatching when daytime temperatures are 70 degrees F. or over for several days and soil moisture is present.

Eight or more grasshoppers per square yard is considered an action level on rangeland and pastures. On field margins of pastures, 21 per square yard or more is considered an action level.

SUGGESTED GRASSHOPPER CONTROL ON PASTURES

Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to: Harvest	Grazing
Carbaryl			
(Sevin® Sprayable, 80% SP)	⅔-1⅞ lb.	0	0
(Sevimol® 4, 4 lb.)	½-1½ qt.	0	0
(Sevin® XLR, 4 lb.)	½-1½ qt.	0	0
(Sevin 4 Oil®, 4 lb.)	½-1½ qt.	0	0
Diazinon (4 lb.)	1 pt.	See remarks.	0
Malathion			
(Cythion®, 5 lb.)	2 pt.	0	0
(Malathion ULV®, 9.33 lb.)	8 oz.	0 See remarks.	0
Naled (Dibrom®, 8 lb.)	½-¾ pt.	0 See remarks.	0
Parathion (4 lb.)	½-¾ pt.	15	15

Remarks

Diazinon. Dairy and beef cattle and sheep can be fed green forage or graze immediately after application. Wait 21 days after application before cutting hay. Do not repeat application for 30 days. Remove animals from pasture during application.

Malathion ULV. Do not apply to clover in bloom.

Naled. Animals may be present during treatment. Do not graze lactating dairy animals on treated areas.

Armyworms. The fall armyworm and true armyworm generally are the most damaging insect pests of improved pastures, winter-temporary pastures, permanent pastures and small grains. These insects commonly occur in spring, late summer or fall and are often associated with wet weather. These pests are easily controlled, but extensive damage may occur before growers notice an infestation. Improved, temporary and permanent pastures as well as small grains should be watched closely during rainy periods in late summer and fall.

Action level is 3 or more small worms per square foot.

SUGGESTED FALL ARMYWORM CONTROL ON PASTURES

Insecticides (listed alphabetically) Toxicant per gallon or pound	Concentrate per acre	Days from last application to: Harvest	Grazing
Carbaryl			
(Sevin® Sprayable, 80% WP)	1¼-1⅞ lb.	0	0
(Sevimol® 4, 4 lb.)	1-1½ qt.	0	0
(Sevin® XLR, 4 lb.)	1-1½ qt.	0	0
Naled (Dibrom®, 8 lb.)	1 pt.	0	0
		See remarks.	
Trichlorfon			
(Dylox®, 80% SP)	1¼ lb.	0	0
(Dylox® Liquid Solution, 4 lb.)	2 pt.	0	0
		See remarks.	

Remarks

Naled. Animals may be present during treatment. Do not graze lactating dairy animals on treated areas.

Trichlorfon. Do not apply more than three times per season if crop is not cut for hay. Applications may be made without removal of grazing livestock. Use immediately after mixing. Avoid using alkaline water as carrier or add a buffering agent to reduce the pH into the acid range.

Desert Termites. Desert termites (Isoptera: *Termitidae*) will infest coastal bermuda pasture and bunch grass areas. Populations will become more severe during years when the summer months are extremely dry. Highest aboveground populations occur during the months of March through September. Few or no termites are present aboveground during the months of December through February. Infestations occur in a circular pattern and are enhanced by the higher clay content of the soil. Clay chimneys covering grass stems are built during the night or cooler parts of the day by the worker and soldier termites. Infested areas have a dark and unusual appearance as populations increase. Rainfall will naturally decrease termite numbers but termites become very active following rains. If dry weather continues and stand loss of the grass is occurring, a chemical spot treatment is suggested. A spring-toothed harrow or light disc harrow must be used to break up chimneys and expose developing termites.

There are no specific insecticides labeled for desert termite control in pastures, but several insecticides labeled for other insects in pastures may help to reduce their populations. *Malathion (5 lb. EC)* has been used at the rate of 1 quart per acre applied in 35 to 40 gallons of water. Two treatments should be applied to the infested areas on a weekly schedule. A length of chain should be dragged ahead of the spray boom to break up the chimneys and expose termites to the insecticide.

Red Imported Fire Ants. In the eastern half of Texas, red imported fire ants (*Solenopsis invicta*) can be a serious problem to forage production. The ants build large mounds that sometimes attain a diameter of one to two feet or more. Farm and pasture lands may become heavily infested with up to thirty (30) mounds per acre. In the hot summer sun, these mounds may become hard, and farm machinery is often broken when a mound is hit. In an effort to reduce machinery damage, farmers may be forced to alter harvesting practices, thus reducing yield.

Currently, there are few insecticides labeled for imported fire ant control. Products containing diazinon (AC-500®), chlorpyrifos (Dursban®) and methyl chloroform (MC 96®) may be used for individual mound treatment. AMDRO® is registered both for broadcast and individual mound applications.

Acknowledgment

The authors gratefully acknowledge the assistance of George L. Teetes, research entomologist, Jesse Cocke and Roy Parker, Extension entomologists, in preparing this publication.

[Blank Page in Original Bulletin]

The information given herein is for educational purposes only. Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement by the Cooperative Extension Service is implied.

Educational programs conducted by the Texas Agricultural Extension Service serve people of all ages regardless of socioeconomic level, race, color, sex, religion or national origin.

Cooperative Extension Work in Agriculture and Home Economics, The Texas A&M University System and the United States Department of Agriculture cooperating. Distributed in furtherance of the Acts of Congress of May 8, 1914, as amended, and June 30, 1914.
25M—3-82 ENT, AGR